

WHAT IS CLAIMED IS:

1. An ultrasonic probe for microscopic operations comprising:

an ultrasonic probe body having a transducer assembly attached to the distal end of a soft elongated tube that is extended from a connector to be coupled to an ultrasonic observation apparatus, and having a coupler mounted on the tube;

an elongated tubular member through which said transducer assembly and tube are passed, and a bent handle member attached to the proximal end of said tubular member and includes a coupling mechanism for use in coupling said coupler to the handle member so that said coupler can be uncoupled freely.

2. An ultrasonic probe for microscopic operations usable for cerebral surgery comprising:

an ultrasonic probe body having a transducer assembly attached to the distal end of a soft elongated tube that is extended from a connector to be coupled to an ultrasonic observation apparatus, and having a base member that serves as a coupler mounted on the middle of the tube; and

an observation body including a linkage pipe through which said transducer assembly and tube are passed, and a

bent handle member that is attached to the proximal end of the linkage pipe and that has a base placement portion serving as a hand-held portion and including a coupling mechanism for use in coupling said base member to the handle member so that said base member can be uncoupled freely.

3. An ultrasonic probe for microscopic operations according to Claim 2, wherein said transducer assembly is mechanically driven, and composed of an ultrasonic transducer, a housing that accommodates the ultrasonic transducer, a flexible shaft that has one end thereof coupled to the housing, has the other end coupled to said ultrasonic observation apparatus, and conveys driving torque, and a soft tube member with which the flexible shaft is sheathed.

4. An ultrasonic probe for microscopic operations according to Claim 2, wherein: said transducer assembly is electronically driven, and composed of a plurality of transducer elements arranged regularly, and a signal cable having signal lines sheathed with a soft tube member; and the signal lines are extended from the plurality of transducer elements, coupled to said ultrasonic observation apparatus, and used to transmit or receive electric signals.

5. An ultrasonic probe for microscopic operations according to Claim 3, wherein: said observation body includes a linkage pipe having an ultrasound transmissive cap, which has a space in which said housing fixed to the distal end of said flexible shaft is placed, attached to the distal end thereof; a pipe placement portion in which the proximal part of the linkage pipe is locked is formed as one end portion of said handle member; and a base placement portion which serves as a hand-held portion and in which said base member is placed is formed as the other end portion of said handle member.

6. An ultrasonic probe for microscopic operations according to Claim 3, wherein: said observation body includes a linkage pipe having a distal opening through which said transducer assembly is jugged out; a pipe placement portion in which the proximal part of the linkage pipe is locked is formed as one end portion of said handle member; and a base placement portion which serves as a hand-held portion and in which said base member is placed is formed as the other end portion of said handle member.

7. An ultrasonic probe for microscopic operations according to Claim 5, wherein: said observation body includes a pipe placement hollow which is bored in said pipe

placement portion and in which the proximal part of said linkage pipe is locked, and a base placement hollow which is bored in said base placement portion and in which said base member is placed; said pipe placement hollow and said base placement hollow have such a positional relationship that the centerlines (axes) thereof are uneven, and are linked by a sloping hollow.

8. An ultrasonic probe for microscopic operations according to Claim 6, wherein: said observation body includes a pipe placement hollow which is bored in said pipe placement portion and in which the proximal part of said linkage pipe is locked, and a base placement hollow which is bored in said base placement portion and in which said base member is placed; said pipe placement hollow and said base placement hollow have such a positional relationship that the centerlines (axes) thereof are uneven, and are linked by a sloping hollow.

9. An ultrasonic probe for microscopic operations according to Claim 5, wherein said observation body includes a locking member used to lock said base member, which is placed in said base placement hollow, at a predetermined position so that said base member can be unlocked freely.

10. An ultrasonic probe for microscopic operations according to Claim 6, wherein said observation body includes a locking member used to lock said base member, which is placed in said base placement hollow, at a predetermined position so that said base member can be unlocked freely.

11. An ultrasonic probe for microscopic operations according to Claim 5, wherein at least said ultrasound transmissive cap and handle member are so transparent that their interiors can be discerned.

12. An ultrasonic probe for microscopic operations according to Claim 5, wherein said ultrasound transmissive cap included in said observation body is freely detachably attached to said linkage pipe.

13. An ultrasonic probe for microscopic operations according to Claim 12, wherein said ultrasound transmissive cap is shaped differently from another ultrasonic transmissive cap so that said ultrasound transmissive cap and another ultrasonic transmissive cap will match different regions to be observed.

14. An ultrasonic probe for microscopic operations according to Claim 5, wherein said linkage pipe included in

said observation body is a hard pipe shaped straight.

15. An ultrasonic probe for microscopic operations according to Claim 6, wherein said linkage pipe included in said observation body is a hard pipe shaped straight.

16. An ultrasonic probe for microscopic operations according to Claim 5, wherein said linkage pipe is a shape varying/maintaining pipe capable of being deformed freely and maintaining a changed shape.

17. An ultrasonic probe for microscopic operations according to Claim 6, wherein said linkage pipe is a shape varying/maintaining pipe capable of being deformed freely and maintaining a changed shape.

18. An ultrasonic probe for microscopic operations according to Claim 14, wherein said straight-shaped hard pipe lies substantially parallel to the centerline (axis) of said base placement portion.

19. An ultrasonic probe for microscopic operations according to Claim 15, wherein said straight-shaped hard pipe lies substantially parallel to the centerline (axis) of said base placement portion.

20. An ultrasonic probe for microscopic operations according to Claim 14, wherein said straight-shaped hard pipe and the centerline (axis) of said base placement portion meets at an angle  $\theta$ .

21. An ultrasonic probe for microscopic operations according to Claim 14, wherein said straight-shaped hard pipe and the centerline (axis) of said base placement portion meets at an angle  $\theta$ .

22. An ultrasonic probe for microscopic operations according to Claim 5, wherein the weight of said observation body ranges 10 g to 50 g.

23. An ultrasonic probe for microscopic operations according to Claim 6, wherein the weight of said observation body ranges 10 g to 50 g.

24. An ultrasonic probe for microscopic operations according to Claim 5, the overall length of said observation body ranges from 200 mm to 270 mm.

25. An ultrasonic probe for microscopic operations according to Claim 6, the overall length of said observation

body ranges from 200 mm to 270 mm.

26. An ultrasonic probe for microscopic operations according to Claim 3, wherein said ultrasound transmissive cap has a reflecting mirror surface, which is inclined substantially  $45^\circ$  and realized with an ultrasonic mirror for reflecting ultrasonic waves, opposed to the lateral surface of said rotating ultrasonic transducer.

27. An ultrasonic probe for microscopic operations according to Claim 2, wherein a fluid supply channel through which a fluid is supplied and a suction channel through which a fluid is sucked are included in said observation body.

28. An ultrasonic probe for microscopic operations according to Claim 2, wherein depth indices used to notify a user of a length of insertion by which said ultrasonic probe has been inserted, and a scanned plane index used to notify a user of the position of a scanned forward plane are marked on said observation body.

29. An ultrasonic probe for microscopic operations according to Claim 3, wherein a thick portion that helps orient a distal cap is formed as part of the distal cap

linked to the distal end of said handle member.

30. An ultrasonic probe for microscopic operations according to Claim 3, wherein a reflector that helps orient said transducer assembly is located in front of the radiating surface of said transducer assembly, or a fluid supply channel or a suction channel is extended to have the distal end thereof located near the distal end of said transducer assembly.

31. An ultrasonic probe for microscopic operations according to Claim 4, wherein a reflector that helps orient said transducer assembly is located in front of the radiating surface of said transducer assembly, or a fluid supply channel or a suction channel is extended to have the distal end thereof located near the distal end of said transducer assembly.

32. An ultrasonic probe for microscopic operations according to Claim 3, wherein said flexible shaft is composed of flexible shafts having different diameters, and one of the flexible shafts, that is, a small-diameter flexible shaft is passed through said observation body.